IN THE CLAIMS

Please amend the claims as follows:

Please cancel claims 1-31.

1-31 (cancelled)

Please add new claims 32-69.

1   32. (new) A method for estimating a property of a fluid, comprising:

2   (a) transmitting a first acoustic pulse in a first member that is in contact with the

3   fluid;

4   (b) detecting a plurality of acoustic pulse echo returns from an interface between

5   the first member and the fluid; and

6   (c) estimating the property of the fluid from the plurality of acoustic pulse echo

7   returns.

1   33. (new) The method of claim 1, wherein the property of the fluid comprises one of

2   acoustic impedance, density and viscosity of the fluid.

1   34. (new) The method of claim 1, further comprising:

2   estimating a reflection coefficient of the interface between the first member and

3   the fluid.

1   35. (new) The method of claim 1, further comprising:

2   estimating an acoustic impedance of the first member.

8

1   36. (new) The method of claim 1, further comprising:

2   estimating a slope of energy decay for the plurality of acoustic pulse echo

3   returns.

1   37. (new) The method of claim 5, wherein estimating the slope of energy decay

2   comprises performing a least squares fit to the plurality of acoustic pulse echo

3   returns.

1   38. (new) The method of claim 5, wherein estimating the slope of energy decay

2   comprises dividing each of the plurality of acoustic pulse echo returns into a

3   plurality of time windows.

1   39. (new) The method of claim 7, wherein estimating the slope of energy decay further

2   comprises integrating over each of the plurality of time windows.

1   40. (new) The method of claim 5, wherein estimating the slope of energy decay further

2   comprises subtracting noise from each of the plurality of acoustic pulse echo

3   returns.

1   41. (new) The method of claim 1, further comprising:

2   transmitting a second acoustic pulse through the fluid; and

9

3   estimating speed of sound through the fluid, using round trip travel time for the

4   second acoustic pulse between the first member and a second member that is in

5   contact with the fluid.

1 42. (new) The method of claim 1, further comprising:

2   transmitting a second acoustic pulse through the fluid; and

3   estimating attenuation of the second acoustic pulse through the fluid.

1 43. (new) The method of claim 11, wherein estimating the attenuation includes

2   estimating the attenuation at a plurality of frequencies.

1 44. (new) The method of claim 10, wherein transmitting the second acoustic pulse

2   further comprises transmitting a plurality of acoustic pulses at a plurality of

3   frequencies.

1 45. (new) The method of claim 1, wherein the method is performed downhole.

1 46. (new) An apparatus for estimating a property of a fluid, comprising:

2   a vessel that contains the fluid;

3   an acoustic pulser that transmits a first acoustic pulse into a first vessel member

4   that is in contact with the fluid;

5   a transducer that detects a plurality of acoustic pulse echo returns from an

6   interface between the first vessel member and the fluid; and

10

7   a processor that estimates the property of the fluid from the plurality of acoustic

8   pulse echo returns.

1 47. (new) The apparatus of claim 15, wherein the vessel comprises one of a flask, pipe,

2   conduit, sample chamber, flow pipe, tube, channel, and downhole tool housing.

1 48. (new) The apparatus of claim 15, wherein the property comprises one of acoustic

2   impedance, density and viscosity of the fluid.

1 49. (new) The apparatus of claim 17, wherein the processor estimates a reflection.

2   coefficient of the interface between the first vessel member and the fluid.

1 50. (new) The apparatus of claim 18, wherein the processor measures acoustic

2   impedance of the first vessel member.

1 51. (new) The apparatus of claim 15, wherein the processor estimates a slope of energy

2   decay for the plurality of acoustic pulse returns.

1 52. (new) The apparatus of claim 20, wherein the processor performs a least squares fit

2   to the plurality of acoustic pulse echo returns.

1 53. (new) The apparatus of claim 20, wherein the processor divides each of the plurality

2   of acoustic pulse echo returns into a plurality of time windows to reduce noise.

11

1   54. (new) The apparatus of claim 22, wherein the processor integrates over each of the

2   plurality of time windows.

1   55. (new) The apparatus of claim 20, wherein the processor estimates the slope of

2   energy decay from a value adjusted for noise for each of the plurality of acoustic

3   pulse echo returns.

1   56. (new) The apparatus of claim 15, wherein the acoustic pulser transmits a second

2   acoustic pulse through the fluid and the processor estimates the speed of sound

3   through the fluid using the round trip travel time for the second acoustic pulse

4   between the first vessel member and a second member that is in contact with the   .

5   fluid.

1   57. (new) The apparatus of claim 15, wherein the acoustic pulser transmits a second

2   acoustic pulse through the fluid and the processor estimates attenuation of the

3   second acoustic pulse through the fluid.

1   58. (new) The apparatus of claim 26, wherein the processor estimates the attenuation at

2   a plurality of frequencies.

1   59. (new) The apparatus of claim 25, wherein the acoustic pulser transmits a plurality of

2   pulses at a plurality of frequencies.

12

1   60. (new) The apparatus of claim 15, wherein the apparatus is located downhole.

1   61. (new) A method for estimating a property of a fluid, comprising:

2   (a) generating a first acoustic pulse in the fluid that is in contact with a first

3   member;

4   (b) detecting a plurality of acoustic pulse echo returns from an interface between

5   the first member and the fluid; and

6   (c) estimating the property of the fluid from the plurality of acoustic pulse echo

7   returns.

1   62. (new) An apparatus for estimating a property of a fluid, comprising:

2   a chamber that contains the fluid;

3   a transmitter that sends a first acoustic pulse into the fluid that is in contact with a

4   first chamber member;

5   a transducer that detects a plurality of acoustic pulse echo returns from an

6   interface between the first chamber member and the fluid; and

7   a processor that estimates the property of the fluid using the plurality of acoustic

8   pulse echo returns.

1   63. (new) A downhole tool which is deployed in a borehole for estimating a property of

2   a downhole fluid, comprising:

3   a vessel that contains the fluid;

13

4   an acoustic pulser that transmits a first acoustic pulse into a first vessel member

5   that is in contact with the fluid;

6   a transducer that detects a plurality of acoustic pulse echo returns from an

7   interface between the first vessel member and the fluid; and

8   a processor that estimates the property of the fluid using the plurality of acoustic

9   pulse echo returns.

1   64. (new) The downhole tool of claim 32, wherein the vessel comprises one of a flask,

2   pipe, conduit, sample chamber, flow pipe, tube, channel and downhole tool

3   housing.

1   65. (new) The downhole tool of claim 33, wherein the property comprises one of

2   acoustic impedance, density and viscosity of the fluid.

3

1   66. (new) The downhole tool of claim 34, wherein the processor estimates a reflection

2   coefficient of the interface between the first vessel member and the fluid.

1   67. (new) The downhole tool of claim 32, wherein the processor estimates a slope of

2   energy decay for the plurality of acoustic pulse echo returns.

1   68. (new) The downhole tool of claim 36, wherein the processor performs a least

2   squares fit to the plurality of acoustic pulse echo returns.

14

1   69. (new) A method for estimating a property of a fluid, comprising:

2   (a) generating a first acoustic pulse in a first member that is in contact with the fluid;

3   (b) detecting a plurality of acoustic pulse echo returns from an interface between the

4   first member and the fluid; and

5   (c) estimating the property of the fluid from the plurality of acoustic pulse echo

6   returns.

15